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HEAVY-DUTY FLAT WIPER BLADE ASSEMBLY**BACKGROUND OF THE INVENTION**5 **1. Technical Field**

This invention relates generally to heavy-duty flat wiper blade assemblies.

10 **2. Related Art**

Heavy-duty flat wiper blade assemblies are known having a straight body mounting a rubber wiper element. In one known construction, the body is extruded from a plastic which is, in turn, reinforced by a metal stiffener to provide sufficient structural rigidity to the body, as shown in United States Patent No. 3,107,384. In another known construction, the body is fabricated from a strip of steel which is bent into a generally U-shaped profile in cross-section and crimped along its length to the rubber wiper element to secure the wiper element. In this case, the flat steel body component is cut to length along with the wiper element prior to folding the flat steel over the wiper element.

Both such constructions are costly to manufacture and are limited in the features and advantages they can offer.

20 Heavy-duty flat wiper blade assemblies constructed according to the present invention overcome or greatly minimize the foregoing limitations of prior wiper blade assemblies.

SUMMARY OF THE INVENTION

A heavy-duty flat wiper blade assembly has a wiper element and an extruded metallic frame. The frame has a bottom channel with a slot and an upper channel separate from the bottom channel. The wiper element is disposed in the
5 bottom channel and extends through the slot to make contact with a surface to be wiped. The upper channel is closed and may optionally be provided with a fluid inlet opening for receiving wiper fluid into the channel and a fluid outlet opening for discharging the wiper fluid from the upper channel and onto a surface to be wiped.

Additionally, a method for manufacturing a wiper blade is provided
10 wherein a wiper element is slidably inserted into a bottom channel of an extruded metallic frame. The wiper element depends from the bottom channel and through a slot in the bottom channel to make wiping contact with a surface to be wiped. A wall of the bottom channel is then staked to fix the wiper element within the bottom channel. An optional method eliminates the staking step and installs a pair of end
15 plugs into each end of the frame to releasably maintain the wiper element within the bottom channel.

Some advantages of the invention include providing for increased efficiencies in the manufacture and assembly of a heavy-duty wiper blade assembly by reducing the number of operations required to produce the wiper blade assembly,
20 by reducing the scrap, by improving the handling of the wiper blade components during assembly and by reducing the time required for assembly, thus reducing the total costs of producing the wiper blade assembly.

Another advantage of the invention is the ability to utilize the closed upper channel as a passage for conveying wiper fluid from which the fluid may be dispensed directly on the surface to be wiped.

Another advantage of the invention is a reduction in the amount of
5 material used in the wiper element.

THE DRAWINGS

These and other features and advantages of the present invention will become more readily appreciated when considered in connection with the following
10 detailed description and appended drawings, wherein:

Figure 1 is a perspective view of a wiper blade assembly showing a first preferred embodiment of the present invention;

Figure 2 is a cross-sectional view taken generally along lines 2-2 of

Figure 1;

15 Figure 3 is a front elevation view of a second embodiment of the present invention;

Figure 4 is a fragmentary isometric view of the blade assembly of Figure 3;

Figure 5 is a cross-sectional view taken generally along lines 5-5 of

20 Figure 4;

Figure 6 is a cross-sectional view taken generally along lines 6-6 of Figure 4; and

Figure 7 is an enlarged fragmentary elevation view, shown partly in section, of Figure 4.

DETAILED DESCRIPTION

Figures 1 and 2 show a heavy-duty wiper blade assembly 10 constructed according to a first preferred embodiment of the present invention. The wiper blade assembly 10 has an extruded frame 12 having a bottom channel 14 that receives a wiper element 16, and an upper channel 18 that is separate from the bottom channel 14. The wiper element 16 is slidably received in the bottom channel 14 and is maintained in the bottom channel 14 by a protuberance or preferably a plurality of protuberances 20.

The frame 12 of the wiper blade assembly 10 is extruded from a metallic material, such as aluminum, or any other extrudable metallic material. The finished frame 12 has a pair of ends 24, 26. The bottom channel 14 and upper channel 18 extend between the ends 24, 26.

The bottom channel 14 has slot 28 formed along the bottom channel 14 between the pair of ends 24, 26 having openings 27, 29 such that a bottom surface 30 of the bottom channel 14 preferably has a pair of opposing lips 31, 32 extending generally toward one another, thus causing the bottom channel 14 to be generally C-shaped in cross-section, as shown best in Figure 2.

The upper channel 18 of the frame 12 is a generally closed channel other than openings 34, 36 at the ends 24, 26 of the frame 12, and an aperture 38 formed in a sidewall or opposing sidewalls 40, 42 of the upper channel 18 between the ends 24, 26 of the frame 12.

The aperture 38 formed in the opposing sidewalls 40, 42 of the upper channel 18 is preferably formed equidistant from either end 24, 26 and receives a

mounting pin (not shown) therethrough so that the wiper blade assembly 10 can be attached to a wiper arm (not shown).

As best shown in Figure 2, the wiper element 16 has a crown portion 44, a neck portion 46, a bumper portion 48, a hinge portion 50, and a body portion 52.

- 5 The wiper element 16 is received by the bottom channel 14 by sliding the crown portion 44 of the wiper element 16 into one of the openings 27, 29 of the bottom channel 14. The pair of opposing lips 31, 32 forming the bottom surface 30 of the bottom channel 14 extend generally inwardly toward the neck portion 46 such that they capture and releasably maintain the wiper element 16. Though the wiper element
- 10 16 is releasably maintained within the channel 14 by the lips 31, 32, the wiper element 16 is still able to slide transversely within the bottom channel 14.

- Preferably, the crown portion 44 of the wiper element 16 conforms generally in shape to the bottom channel 14. A bottom surface 53 of the crown portion 44 is preferably in mating contact with an upper surface 54 of the lips 31, 32 such that the crown portion 44 is maintained within the bottom channel 14 during assembly 10. The neck portion 46 of the wiper element 16 depends from the crown portion 44 and passes between the lips 31, 32 of the frame 12 and joins the bumper portion 48 of the wiper element 16. The bumper portion 48 of the wiper element 16 contacts the bottom surface 30 of the lips 31, 32. The wiper element 16 can be secured against relative sliding movement within the channel 14 by staking a side-wall or sidewalls 40, 42 of the bottom channel 14, such that a plurality of protuberances 20 extend laterally inwardly into gripping engagement with the crown portion 44 of the wiper element 16. As shown in Figure 1, preferably two protuberances 20 are staked adjacent each end 24, 26 of each side-wall 40, 42 of the

frame 12. However, it should be recognized that any number of protuberances 20 may be staked depending on the requirements of the wiper blade application.

Figures 3-7 show an alternative embodiment of a wiper blade assembly of the invention generally at 110. The same reference numerals are used to designate 5 like features to those of the first embodiment, but are offset by 100. The assembly 110 includes an upper channel 118 in which a pair of end plugs 22, 23 are installed. The channel 118 communicates with a source of pressurized wiper fluid (not shown) through one of the end plugs 22, 23. The wiper fluid can travel through and be dispensed from the upper channel 118 directly onto the surface to be wiped by the 10 wiper blade assembly 110. Also, the wiper element 116 is preferably releasably maintained in the bottom channel 114 by a bottom portion 56 of the pair of end plugs 22, 23, thus enabling the wiper element 116 to be quickly and easily replaced when needed. It should be recognized however, that a staking operation could be used here as performed in the first preferred embodiment.

15 The pair of end plugs 22, 23 are preferably sized so that they can be press fit into the openings 134, 136 at the ends 124, 126 of the upper channel 118 such that they have an interference fit or other suitable mechanical retention (e.g. latches), and create a generally fluid tight seal therein. The end plugs 22, 23 are shaped to have a plug portion 58 that fits within the upper channel 118, and a face 20 portion 60 that remains in mating contact with an end 124, 126 of the frame 112. One end plug 22 preferably has a through hole 62 such that a hose 64 can be connected in the through hole 62 of the end plug 22 to provide for communication of fluid between the upper channel 118 and the source of pressurized wiper fluid. The wiper fluid can then be received within the upper channel 118 of the wiper blade assembly 110 and be

dispensed from the upper channel 118 through a nozzle 64 and directed onto the surface to be wiped by the wiper blade assembly 110. It should be recognized however, that the hose 64 could be received in an opening anywhere along the upper channel 118 between the two ends 24, 26 of the upper channel 118, and not through 5 one of the end plugs 22, 23 in the pair of ends 124, 126 of the frame 112.

The end plugs 22, 23 preferably extend downwardly from the upper channel 118 so that the face portion 60 blocks or covers at least a portion of the bottom channel 114. With at least one end plug 22, 23 removed from the bottom channel 114, the wiper element 116 can be slidably received within the bottom 10 channel 114, and the end plug or end plugs 22, 23 can then be press fit into the bottom channel 114. The face portions 60 of the plugs 22, 23 then releasably maintain the wiper element 116 within the bottom channel 114. If the wiper element 116 needs replacing, one of the end plugs 22, 23 can simply be removed to slidably remove the wiper element 116 from the bottom channel.

15 As best shown in Figure 6, another opening 66 in one of the side walls 40, 42 of the upper channel 118 has the nozzle 64 received therein. The nozzle 64 is fixed in the opening 66 of the upper channel 118 such that the nozzle 64 is maintained in sealing engagement with the opening 66. The nozzle 64 has a through hole 68 that is formed to dispense wiper fluid from the upper channel 118 such that the wiper fluid 20 exits preferably in a desired spray pattern. The nozzle 64 is shown here to be generally equidistant between the two ends 24, 26 of the upper channel 118. It should be recognized however, that the opening 66 used to receive the nozzle 64 can be placed anywhere along the length between the two ends 24, 26 of the upper channel 118, as best suited for the application. It should also be recognized that any number

of nozzles 64 can be employed within the sidewalls 140, 142 to insure adequate coverage of wiper fluid on the surface to be wiped by the wiper blade assembly 110.

As best shown in Figure 5, a grommet 70 is installed in the aperture 138 to create a fluid tight seal between the mounting pin and the upper channel 118 to prevent any wiper fluid from leaking between the aperture 138 and the mounting pin. Ends 72, 74 of the grommet 70 are formed with radially enlarged flanges 76, 78 for securing and sealing the grommet 70 within the aperture 138. The grommet 70 has a tubular body passing through the upper channel 118, defining a through hole 80 for accommodating the mounting pin (not shown). Other suitable means for creating a seal between the aperture 138 and the mounting pin to prevent wiper fluid from exiting the aperture 138 is contemplated by this invention, such as applying a coating to the walls of the aperture 138 or to the mounting pin so that the coating provides a fluid-tight seal.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described. The invention is defined by the claims.